Webasto
Feel the drive

Wasserheizgeräte
Water Heaters
Chauffages à eau

Einbauanweisung
Installation Instructions
Instructions de montage

Thermo 90 S
Thermo 90 ST

Thermo 90 S	(Benzin) (Petrol) (Essence)
Thermo 90 S	(Diesel) (Gas-oil)
Thermo 90 S-ADR	(Gefahrguttransport) (Transport of hazardous goods) (Transport de marchandises dangereuses)
Thermo 90 ST	(Benzin) (Petrol) (Essence)
Thermo 90 ST	(Diesel) (Gas-oil)
Thermo 90 ST-ADR	(Gefahrguttransport) (Transport of hazardous goods) (Transport de marchandises dangereuses)

05/2008
1301494C

Das unsachgemäße Einbauen oder Reparieren von Webasto Heiz- und Kühlsystemen kann Feuer verursachen oder zum Austritt von tödlichem Kohlenmonoxid führen. Dadurch können schwere oder tödliche Verletzungen hervorgerufen werden.

Für den Einbau und die Reparatur von Webasto Heiz- und Kühlsystemen bedarf es eines Webastotrainings, technischer Dokumentation, Spezialwerkzeuge und einer Spezialausrüstung.

Versuchen Sie NIEMALS, Webasto Heiz- oder Kühlsysteme einzubauen oder zu reparieren, wenn Sie das Webastotraining nicht erfolgreich abgeschlossen und dabei die notwendigen technischen Fähigkeiten erworben haben und die für einen sachgerechten Einbau und Reparatur nötigen technischen Dokumentationen, Werkzeuge und Ausrüstungen nicht zur Verfügung stehen.

Befolgen Sie IMMER alle Webasto Einbau- und Reparaturanleitungen, und beachten Sie alle Warnhinweise.

Webasto übernimmt keine Haftung für Mängel und Schäden, die auf einen Einbau durch ungeschultes Personal zurückzuführen sind.

Improper installation or repair of Webasto heating and cooling systems can cause fire or the leakage of deadly carbon monoxide leading to serious injury or death.

To install and repair Webasto heating and cooling systems you need to have completed a Webasto training course and have the appropriate technical documentation, special tools and special equipment.

NEVER try to install or repair Webasto heating or cooling systems if you have not completed a Webasto training course, you do not have the necessary technical skills and you do not have the technical documentation, tools and equipment available to ensure that you can complete the installation and repair work properly.

ALWAYS carefully follow Webasto installation and repair instructions and heed all WARNINGS.

Webasto rejects any liability for problems and damage caused by the system being installed by untrained personnel.

La réparation ou l'installation impropre des systèmes de chauffage et de refroidissement Webasto peut conduire à l'incendie de l'appareil ou encore à des fuites mortelles de monoxyde de carbone pouvant entraîner de graves lésions voire même la mort.

Pou l'installation ou la réparation des systèmes de chauffage ou de refroidissement Webasto, il est nécessaire d'avoir une formation Webasto, une documentation technique, des outils spécifique et des équipements particuliers.

N'essayez JAMAIS d'installer ou de réparer un système de chauffage ou de refroidissement Webasto si vous n'avez pas suivi avec succès la formation Webasto et obtenu ainsi les capacités techniques indispensables et si vous ne disposez pas de la documentation technique, des outils et des équipements nécessaires à une installation ou à une réparation dans les règles de l'art.

TOUJOURS suivre scrupuleusement les instructions Webasto relatives à l'installation et à la réparation des appareils et tenir compte de toutes les MISES EN GARDE.

Webasto décline toute responsabilité en cas de problème ou de dommage causé par un système ayant été installé par du personnel non qualifié.

Inhaltsverzeichnis

Table of contents

1 Statutory regulations governing installation

1.1. Statutory regulations governing installation

The Thermo 90 S / Thermo 90 ST heater has been type-tested and approved in accordance with EC Directives 72/245/EEC (EMC), 2001/56/EC (heater) and ECE R122 with the following EC permit numbers:

e1*2001/56*2004/78*0005*--
e1*72/245*95/54*1173*--
e1*2001/56*2004/78*0019*--
E1 R122 00 0217

Primarily the regulations of Annex VII of the Directive 2001/56/EG and Part 2 or Annex 7 of the directive ECE R122 must be observed for the installation.

NOTE:
The provisions of these Directives are binding within the territory governed by EU Directive 70/156/EEC and should similarly be observed in countries without specific regulations.

IMPORTANT
Failure to follow the installation instructions and the notes contained therein will lead to all liability being refused by Webasto. The same applies if repairs are carried out incorrectly or with the use of parts other than genuine spare parts. This will result in the invalidation of the type approval for the heater and therefore of its *homologation / EC type licence*.

(Extract from Directive 2001/56/EC Annex VII)

1.7.1. A clearly visible tell-tale in the operator's field of view shall inform when the combustion heater is switched on or off.

2. Vehicle installation requirements

2.1. Scope

*2.1.1.*Subject to paragraph 2.1.2, combustion heaters shall be installed according to the requirements of this Annex.
*2.1.2.*Vehicles of category O (*trailers*) having liquid fuel heaters are deemed to comply with the requirements of this Annex.

2.2. Positioning of heater

2.2.1. Body sections and any other components in the vicinity of the heater must be protected from excessive heat and the possibility of fuel or oil contamination.
2.2.2. The combustion heater shall not constitute a risk of fire, even in the case of overheating. This requirement shall be deemed to be fulfilled if the installation ensures an adequate distance to all parts and suitable ventilation, by the use of fire resistant materials or by the use of heat shields.
2.2.3. In the case of M2 and M3 vehicles, the heater must not be positioned in the passenger compartment. However, an installation in an effectively sealed envelope which also complies with the conditions in paragraph 2.2.2 may be used.
2.2.4. The label referred to in paragraph 1.4 (*model plate*), or a duplicate (*duplicate model plate*), must be positioned so that it can be easily read when the heater is installed in the vehicle.

2.2.5 Every reasonable precaution should be taken in positioning the heater to minimise the risk of injury and damage to personal property.

2.3. Fuel supply

2.3.1. The fuel filler must not be situated in the passenger compartment and must be provided with an effective cap to prevent fuel spillage.
2.3.2. In the case of liquid fuel heaters, where a supply separate to that of the vehicle is provided, the type of fuel and its filler point must be clearly labelled.
2.3.3. A notice, indicating that the heater must be shut down before refuelling, must be affixed to the fuelling point. In addition a suitable instruction must be included in the manufacturer's operating manual.

2.4. Exhaust system

2.4.1. The exhaust outlet must be located so as to prevent emissions from entering the vehicle through ventilators, heated air inlets or opening windows.

2.5. Combustion air inlet

2.5.1. The air for the combustion chamber of the heater must not be drawn from the passenger compartment of the vehicle.
2.5.2. The air inlet must be so positioned or guarded that blocking by rubbish or luggage is unlikely.

2.6. Heating air inlet

2.6.1. The heating air supply may be fresh or recirculated air and must be drawn from a clean area not likely to be contaminated by exhaust fumes emitted either by the propulsion engine, the combustion heater or any other vehicle source.
2.6.2. The inlet duct must be protected by mesh or other suitable means.

2.7. Heating air outlet

2.7.1. Any ducting used to route the hot air through the vehicle must be so positioned or protected that no injury or damage could be caused if it were to be touched.
2.7.2. The air outlet must be so positioned or guarded that blocking by rubbish or luggage is unlikely.

2.8. Automatic control of the heating system

The heating system must be switched off automatically and the supply of fuel must be stopped within five seconds when the vehicle's engine stops running.
If a manual device is already activated, the heating system can stay in operation.

NOTE:
Contrary to point *2.2.3* the heater must also not be installed in the passenger cabin of class M1 and N vehicles. However, an installation in an effectively sealed envelope which also complies with the conditions in paragraph *2.2.2* may be used.

(**Extract from Directive 2001/56/EC Annex IX)**

3. Technical specifications for heater units for installation in dangerous goods transporters (Annex 9)

3.1. General (EX/II, EX/III, AT, FL and OX vehicles)

3.1.1. The combustion heaters and their exhaust gas routing shall be designed, located, protected or covered so as to prevent any unacceptable risk of heating or ignition of the load. This requirement shall be considered as fulfilled if the fuel tank and the exhaust system of the appliance conform to the provisions set out in the points 3.1.1.1 and 3.1.1.2. Compliance with those provisions shall be verified on the completed vehicle.

3.1.1.1. Any fuel tanks for supplying the appliance shall meet the following requirements:

a) in the event of any leakage, the fuel shall drain to the ground without coming into contact with hot parts of the vehicle or the load;
b) fuel tanks containing petrol shall be equipped with an effective flame trap at the filler opening or with a closure enabling the opening to be kept hermetically sealed.

3.1.1.2. The exhaust system as well as the exhaust pipes shall be so directed or protected to avoid any danger to the load through heating or ignition. Parts of the exhaust system situated directly below the fuel tank (diesel) shall have a clearance of at least 100 mm or be protected by a thermal shield.

3.1.2. The combustion heater shall be switched on manually. Programming devices shall be prohibited.

3.2. EX/II and EX/III vehicles

Combustion heaters using gaseous fuels are not permitted.

3.3. FL vehicles

3.3.1. The combustion heaters shall be put out of operation by at least the following methods:

a) intentional manual switching off from the driver's cab;
b) stopping of the vehicle engine; in this case the heating device may be restarted manually by the driver;
c) start-up of a feed pump on the motor vehicle for the dangerous goods carried.

2 Use / version

2.1. Use of the water heaters

The Webasto water heater is used in connection with the vehicle's own heating system

– to heat the cab,
– to defrost the vehicle windows and
– to preheat water-cooled engines.

The water heater operates independently of the engine and is connected to the cooling system, the fuel system and the electrical system of the vehicle.

The Thermo 90 S and Thermo 90 ST heaters differ from each other in their component plug and in the fact that they have different control modules.

2.2. Versions

2.2.1. Thermo 90 S version

Thermo 90 S petrol

Water heater for "petrol" fuel

Thermo 90 S diesel

Water heater for "diesel" fuel

The water heaters are designed for 12 V (Thermo 90 S petrol) and for 12 or 24 V (Thermo 90 S diesel).

2.2.2. Thermo 90 ST version

Thermo 90 ST petrol

Water heater for "petrol" fuel

Thermo 90 ST diesel

Water heater for "diesel" fuel

The water heaters are designed for 12 V (Thermo 90 ST petrol) and for 12 or 24 V (Thermo 90 ST diesel).

3 Installation

IMPORTANT
- The water heater must be installed outside the passenger cabin.
- The requirements of the latest version of the ADR must also be observed for the installing the heater into vehicles used to transport hazardous substances.

NOTE:
If the vehicle manufacturer has issued instructions, they must be followed.

3.1. Installation site / Installation position

The heater must be installed in as low a position as possible to allow the heater and circulating pump to be bled automatically. This is particularly important as the circulating pump is not self-priming.

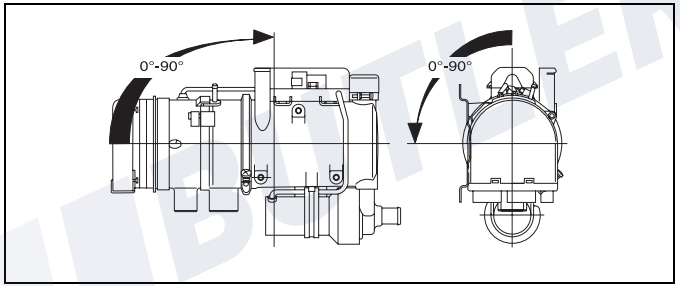


Fig. 1: Permitted installation positions for the Thermo 90 S / Thermo 90 ST

3.2. To install the heater

The heater must be secured with at least three M8 screws. The screws must be tightened with a torque of 18 Nm.

3.3. Model plate

The model plate must be positioned so that it cannot be damaged and must be clearly legible when the heater is installed (otherwise a duplicate model plate must be used).
Inapplicable years must be erased from the model plate.

4 Examples for installation

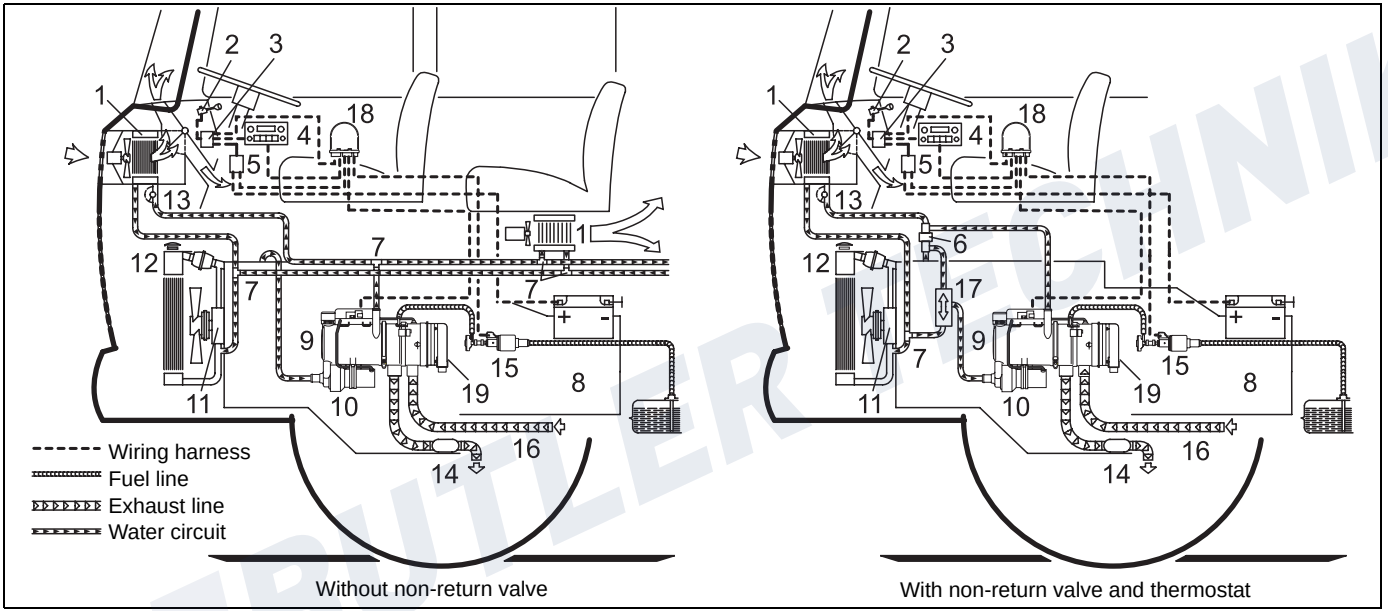


Fig. 2: Installation example for the Thermo 90 S / Thermo 90 ST heater

1 Heat exchanger, car's heating system
2 Switch for car's heating system fan
3 Relay for vehicle fan
4 Digital timer
5 Fuse strip in the car
6 Non-return valve with leakage hole
7 T-piece
8 Vehicle engine
9 Heater
10 Circulating pump
11 Water pump
12 Radiator
13 Regulating valve
14 Exhaust silencer
15 Metering pump
16 Combustion air intake line
17 Thermostat
18 Control module (optional on the Thermo 90 S)
19 Control module (installation position of the Thermo 90 ST and optional for the Thermo 90 S)

5 Connection to the vehicle cooling system

In thermostat circuits, only use thermostats which start to open at < 65 °C.

The heater is connected to the vehicle cooling system as shown in Figure 2. The system must contain at least 6 litres of coolant.

The water hoses supplied by Webasto must always be used. If you do not use these hoses, the hoses that you do use must comply with DIN 73411. The hoses must be installed without kinks and (to ensure perfect bleeding) rising if possible. Hose connections must be supported by hose clips to prevent them slipping.

NOTE:
The hose clips must be tightened with a torque of 4 Nm.

The cooling system must be bled carefully before using the heater for the first time or after replacing the coolant. The heater and lines should be installed in such a way as to ensure static bleeding.

Perfect ventilation can be identified by the circulating pump operating almost silently.

6 Fuel supply

The fuel is taken from the vehicle fuel tank or from a separate fuel tank.

The values for the maximum pressure at the fuel extraction point are shown in the table below.

Permissible fuel inflow height H (m)	**At max. pressure (bar) in fuel line**
0.00	0.2
1.00	0.11
2.00	0.03
Maximum fuel intake height S (m)	**At max. negative pressure (bar) in the fuel tank**
0.00	-0.10
0.50	-0.06
1.00	-0.02

Only for ADR: The statutory regulation of ADR (Accord européen relatif au transport international des marchandises dangereuses par route) governing fuel tanks, part 9 para. 9.2.4.7, must be adhered to.

NOTE:
A sign must be affixed to the fuel filler neck warning that the heater must be switched off before refuelling.

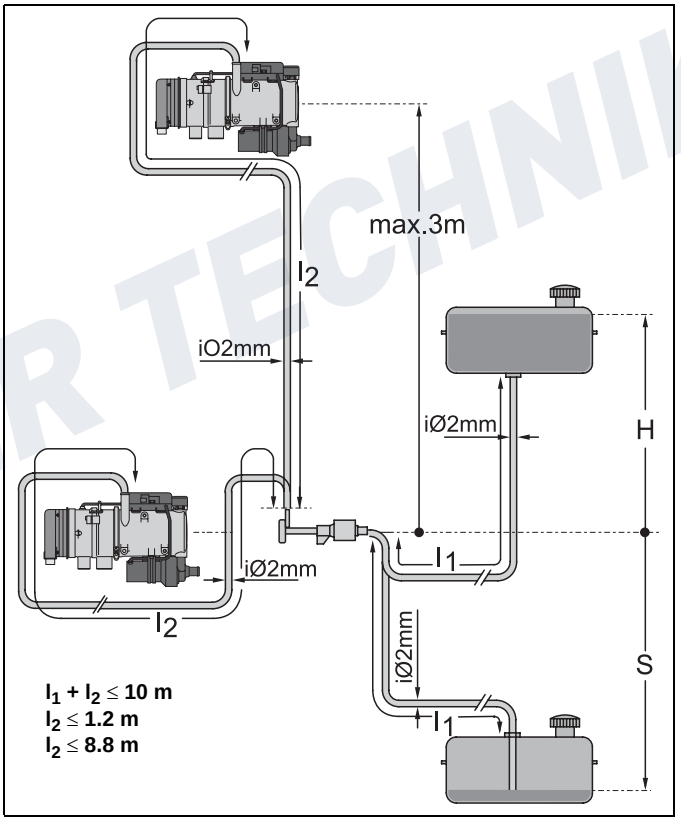


Fig. 3: Fuel supply

6.1. Vehicles with diesel engines

The fuel must be taken from the vehicle fuel tank or from a separate tank (see Figs. 4, 5 and 6).

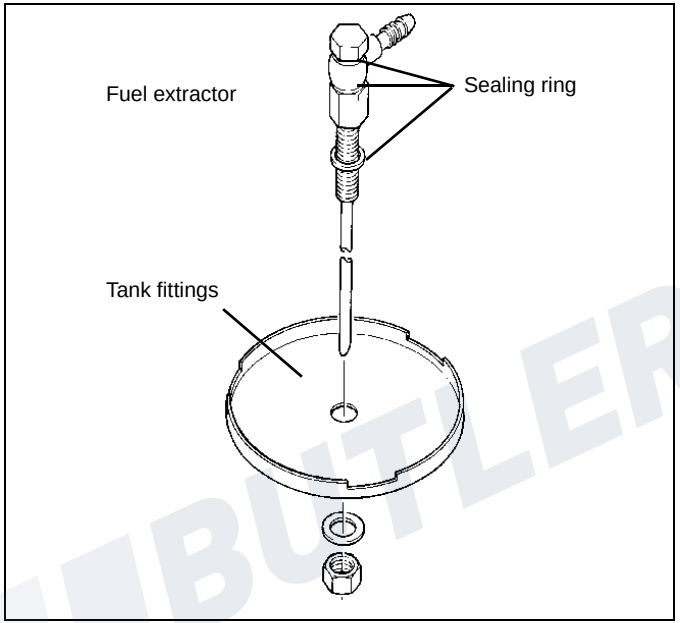


Fig. 4: Fuel pickup from the plastic tank
(Pickup via tank fitting)

NOTE:
Deburr the cut on the tank connector after sawing it off and remove any metal chips.

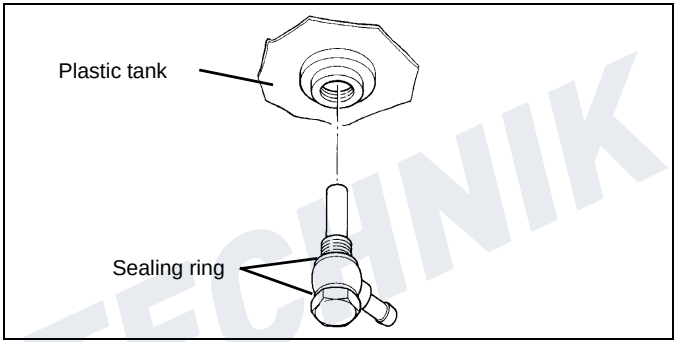


Fig. 5: Fuel pickup from the plastic tank
(Pickup via tank drain screw)

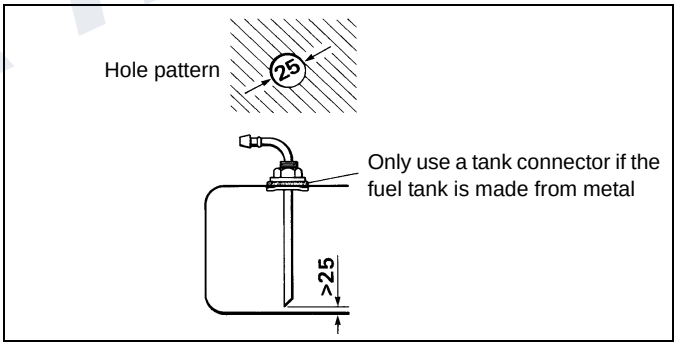


Fig. 6: Webasto tank connector

NOTE on Fig. 6:
The fitting must be made from metal!

6.2. Vehicles with petrol engines

The heater must be integrated into the return line of fuel systems in carburettor and injection engines with a return line.

In carburettor engines without a return line the heater must be integrated into the fuel system in the supply line between the fuel tank and the vehicle pump.

NOTE
A fuel feed line can normally be identified by the fact that a fuel filter is installed in it.

NOTE:
If there is an evaporation tank in the vehicle's fuel system, the fuel must be extracted upstream of the evaporation tank.

Fuel may only be taken from the supply or return line using the special Webasto fuel extractor (see Figure 7).

The fuel extractor must be fitted in such a way that any air or gas bubbles are automatically discharged towards the tank (see Figure 7).

Air or gas bubbles may be produced in the vehicle's fuel line if there are leaks in the carburettor or vehicle fuel pump or if the ambient temperature is higher than the evaporation temperature of the fuel.

The fuel extractor must not be located near the engine, as gas bubbles may form in the lines on account of heat radiated from the engine. This may cause problems during combustion.

When installing the heater in a vehicle with fuel injection system, it is important to establish whether the fuel pump is located inside or outside the tank. If the fuel pump is located inside the tank, fuel can only be extracted from the return line. In this case it must be ensured that the return line continues almost to the bottom of the tank and is not sealed by a non-return valve. If this is not the case the return line may be extended.

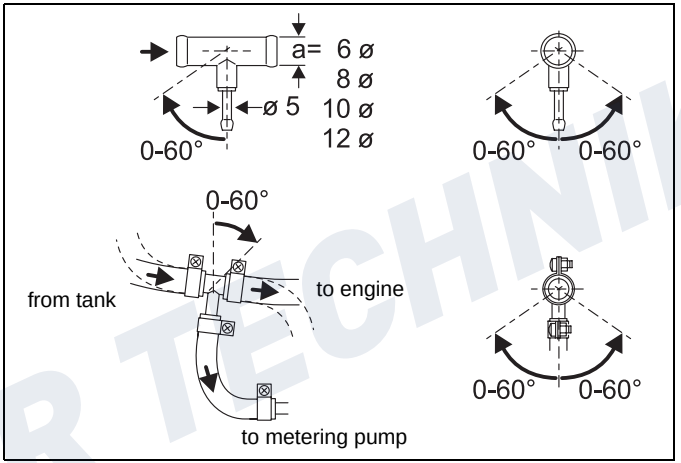


Fig. 7: Webasto fuel extractor

If the fuel pump is installed outside the tank, the fuel connection may be made between the tank and the fuel pump.

6.3. Fuel lines

Only steel, copper and plastic lines of plasticised, light and temperature-stabilized PA 11 or PA 12 (e.g. Mecanyl RWTL) pursuant to DIN 73378 may be used for the fuel lines.

NOTE:
Cut Mecanyl lines without burr and do not crush them. Do not cut them with side-cutting pliers.

Since the lines normally cannot be routed with a constant rising gradient, the internal diameter must not be allowed to exceed a certain size. Air or gas bubbles will accumulate in lines with an internal diameter of more than 4 mm and these will cause malfunctions if the lines sag or are routed downwards. The diameters specified in Figures 3 and 7 will ensure that bubbles do not form.

The lines should not be routed downwards from the metering pump to the heater.

Unsupported fuel lines must be secured to prevent them sagging. They must be installed in such a way that they cannot be damaged by flying chippings and high temperatures (exhaust line).

6.3.1. Connecting two pipes with a hose

The correct procedure for connecting fuel lines with hosing is illustrated in Fig. 8.

NOTE:
Ensure that there are no leaks.

6.4. Metering pump with damper

The metering pump is a combined delivery, metering and shutoff system and is subject to specific installation criteria (see Figs. 3, 9 and 10).

6.4.1. Installation location

Before installing the metering pump, ensure that the maximum pressure occurring at the pickup point is less than 0.2 bar.

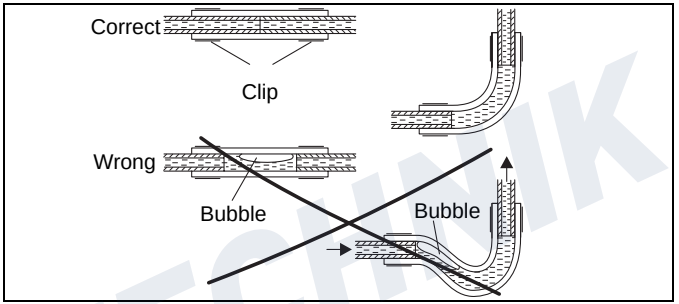


Fig. 8: Pipe / hose connection

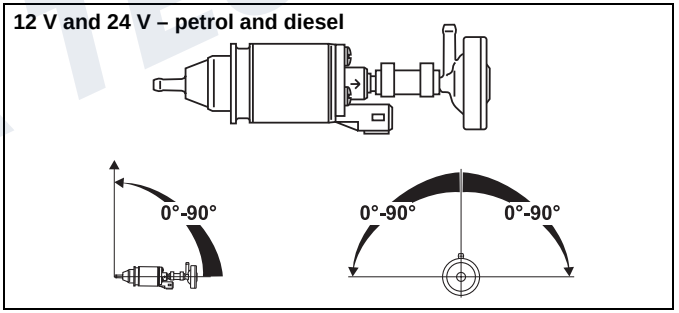


Fig. 9: Metering pump DP2
Installation position and attachment

It is advisable to install the metering pump in a cool place. The maximum ambient temperature must not exceed + 20 °C for petrol and + 40 °C for diesel at any time during operation.

The metering pump and fuel lines must not be installed within range of the radiated heat from hot vehicle parts. A heat shield must be used if necessary.

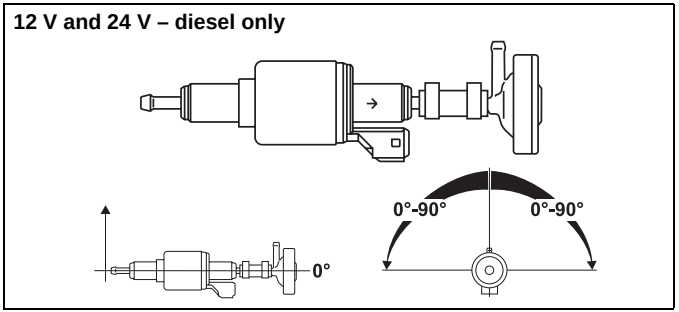


Fig. 10: Metering pump 30.2
Horizontal installation position

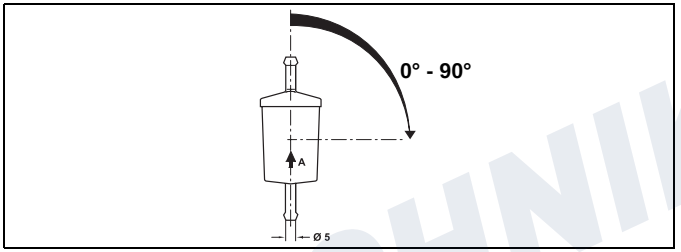


Fig. 11: Fuel filter

The pump should ideally be installed near the tank.

6.4.2. Installation and attachment

The metering pump must be secured with a vibration-damping mounting. Its installation position is limited as shown in Figs. 9 and 10 in order to ensure effective auto-bleeding.

6.5. Fuel filter

Only a Webasto filter, order no. 487 171, is allowed to be used if the fuel is expected to be contaminated. Install vertically if possible, however at least horizontally.

NOTE:
Note the installation position and direction of flow.

7 Combustion air supply

Under no circumstances may the combustion air be taken from areas occupied by people. The combustion air intake opening must not point in the direction of travel. It must be located so that it cannot become clogged with dirt or snow and cannot suck in splashing water.

The combustion air intake line (internal diameter at least 30 mm) may be 0.5 m to 5 m long with several bends totalling 360°. The minimum bending radius is 45 mm.

The combustion air intake must not be routed above the exhaust outlet.

NOTE:
If the combustion air intake line cannot be installed so that it slopes downwards, a water drain hole with a diameter of 4 mm is to be made at its lowest point.

If the heater is installed in a general installation space near the vehicle's fuel tank, the combustion air must be taken in from the outside and the exhaust fumes discharged into the atmosphere. The openings must be splash-proof.

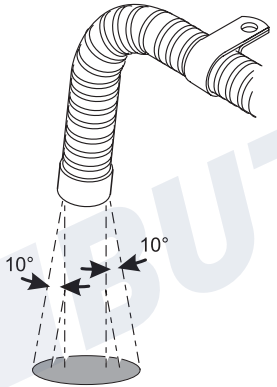
A ventilation opening measuring at least 6 cm^2 is required if the heater is installed in an enclosed box. The size of the ventilation opening must be increased accordingly if the temperature in the box exceeds the permitted ambient temperature of the heater (see Technical data).

8 Exhaust pipe

The exhaust pipe (internal diameter 38 mm) can be installed with a length of 0.5 m to 5 m and several bends (360° altogether, minimum bending radius 85 mm). The exhaust silencer is essential and must be installed near the heater.

The opening of the exhaust pipe must not point towards the front of the vehicle (see Figure 12).

An attachment is required no further than 150 mm from the end of the exhaust pipe to ensure that the angle of 90° ± 10° is achieved



Discharge direction almost vertical 90° ± 10°

Fig. 12: Exhaust pipe opening
Installation position

The exhaust pipe opening must be located so that it cannot become clogged with snow and mud.

Rigid pipes of unalloyed or alloyed steel with a minimum wall thickness of 1.0 mm or flexible piping of alloyed steel only must be used as exhaust line. The exhaust pipe is secured to the heater using a clamping collar, for example. See the statutory regulations for other requirements.

Only for ADR: The statutory regulation of ADR (Accord européen relatif au transport international des marchandises dangereuses par route) governing the routing of the exhaust line, part 9 para. 9.2.4.7, must be adhered to.

9 Electrical connections

9.1. Control module / heater connection

The electrical connection of the heaters is made as shown in the circuit diagrams in Figures 15, 16, 17, 18, 19, 20, 21 and 22.

9.2. Connection when installing Thermo 90 S-ADR and Thermo 90 ST-ADR in a hazchem vehicle (ADR)

To install the Thermo 90 S-ADR and Thermo 90 ST-ADR heaters in hazchem vehicles, the requirements of ADR/RID part 9 para. 9.2.4.7 – Combustion heating systems, must also be satisfied. The electrical connection is made as shown in the circuit diagram, Figs. 17, 18, 21 and 22.

NOTE:
The switch S7 must be installed in such a way that a positive potential is connected to appropriate input of the control module when a pumping device is switched on.

If there is no earth via Y2 or H5 at control module input X12/5 (Thermo 90 S) or X8/5 (Thermo 90 ST) when it is switched on, all the ADR functions are disabled.
After activating the positive potential at control module input X12/5 (Thermo 90 S) or X8/5 (Thermo 90 ST) (auxiliary power take-off on) a brief run-on time of 20 seconds on the Thermo 90 S (40 seconds on the Thermo 90 ST) will take place, following which the control module will be in “Fault lock-out” mode.

IMPORTANT
In accordance with the technical specifications of the act governing the road haulage of hazardous materials, heaters are only allowed to be taken into service with a special manually operated switch fitted in the cab.
If the system is equipped with a standard clock, ensure that contact 4 on the standard clock remains free. The heater can then only be taken into service using the immediate heat button (circuit diagram available on request).
The use of other timers in ADR vehicles is not permitted.

9.3. Connecting the controls

The heater can be switched on and off using the following Webasto controls:

– Timer, see circuit diagrams in Figures 15, 16, 19 or 20.
– Switch, see circuit diagrams in Figures 17, 18, 21 or 22.

9.4. Vehicle fan

The vehicle's own heater fan is controlled using a relay, see circuit diagram Figs. 15, 16, 17, 18, 19, 20, 21, 22 or using a relay with a cabin thermostat.

9.5. Thermo 90 S control module

The control module offers protection type IP6K4K if it is installed in the position shown in Figure 13.

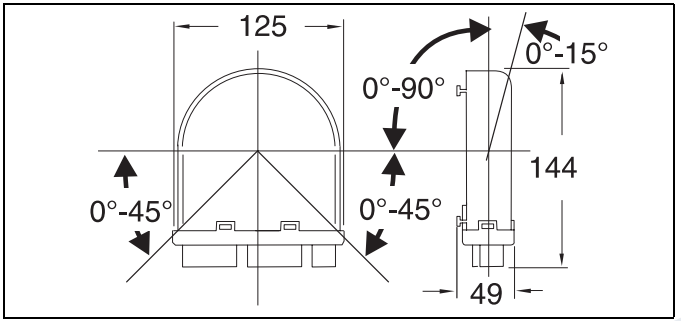


Fig. 13: Thermo 90 S (from 03/97) control module, installation position

9.6. Thermo 90 ST control module

The control module offers protection type 6K9K if it is installed in the position shown in Figure 14.

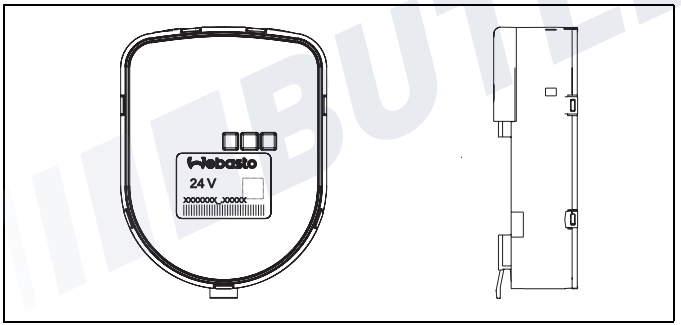


Fig. 14: Thermo 90 ST control module, arbitrary installation position

9.7. To set the regulating temperatures Thermo 90 S / Thermo 90 ST

If the “Engine on”/”Engine off” signal (terminal D+) is applied to control module plug X12 contact 7 (Thermo 90 S) or plug X8 contact 7 (Thermo 90 ST), different regulating thresholds take effect

	Nominal temperature at the sensor	Regulating pause	Switch on again after regulating pause
“Engine on”	72 °C	82 °C	67 °C
“Engine off”	80 °C	90 °C	75 °C

If the terminal D+ signal is not applied, the temperatures are the same as those at “Engine off”.

NOTE:
The selected regulating pause temperature of the heater should be lower than the opening temperature of the radiator thermostat.

10 Circuit diagrams

10.1. Circuit diagram legend for the Thermo 90 S and Thermo 90 ST

① Temperature coding (temperature at water outlet):
See table on page 50

② Digital timer P2:
with positive at connection 10 = Continuous operation with immediate heating
Connection 10 open = Variable heating duration can be programmed (10 min to 120 min); default setting 120 min

③ Vehicle fuse

④ Vehicle blower switch

Cable cross-sections		
	< 7.5 m	7.5 - 15 m
	0.75 mm^2	1.0 mm^2
	0.75 mm^2	1.0 mm^2
	1.0 mm^2	1.5 mm^2
	1.5 mm^2	2.5 mm^2
	2.5 mm^2	4.0 mm^2
	4.0 mm^2	6.0 mm^2

Cable colours	
bl	blue
br	brown
ge	yellow
gn	green
gr	grey
or	orange
rt	red
sw	black
vi	violet
ws	white

10.2. Thermo 90 S circuit diagram legend

Item	Designation	Comment
A1	Heater	
A2	Control module	
B1	Flame sensor	
B2	Temperature sensor	
B3	Temperature limiter/ Overheating guard	
B4	Room thermostat	
E	Glow plug	
F1	Fuse 20 A	Flat fuse SAE J 1284
F2	Fuse 5 A	Flat fuse SAE J 1284
F3	Fuse 20 A	Flat fuse SAE J 1284
H1	“Heating” symbol in the display	Operating indicator (in item P2)
H2	Light max. 2 W	Operating indicator (in item S4)
H3	Symbol light	Light (in item P2)
H5	Lamp, min. 1.2 W	Switch-on indicator pumping device
H6	Red LED	Immediate heat button light, ready indicator, switch-on control (in item P2)
K3	Relay	Circulating pump remote control
K5	Relay	for vehicle fan
M1	Motor	Combustion air fan
M2	Motor	Circulating pump
M3	Motor	Vehicle fan
P2	Digital timer	For programmed operation
S4	Switch	ON/OFF
S5	1 or 2-pin disconnecting switch	Emergency off switch, electric or pneumatic
S7	Pumping device switch	to positive
S8	Momentary-contact switch	Immediate heat button remote control
S9	Switch	Heating/Circulating pump remote control
S10	Switch	Battery switch in positive
X1	12-pin plug connection	to item A1
X3	12-pin plug connection	to item P2
X5	Plug connector, 2-pin	to Y1
X6	Plug connector, 2-pin	Diagnostics
X11	12-pin plug connection	To item A2 (ST 1)
X12	12-pin plug connection	To item A2 (ST 2)
X13	Plug connector, 2-pin	To item A2 (ST 3)
Y1	Metering pump	Fuel pump for heater
Y2	Solenoid valve	for pumping device

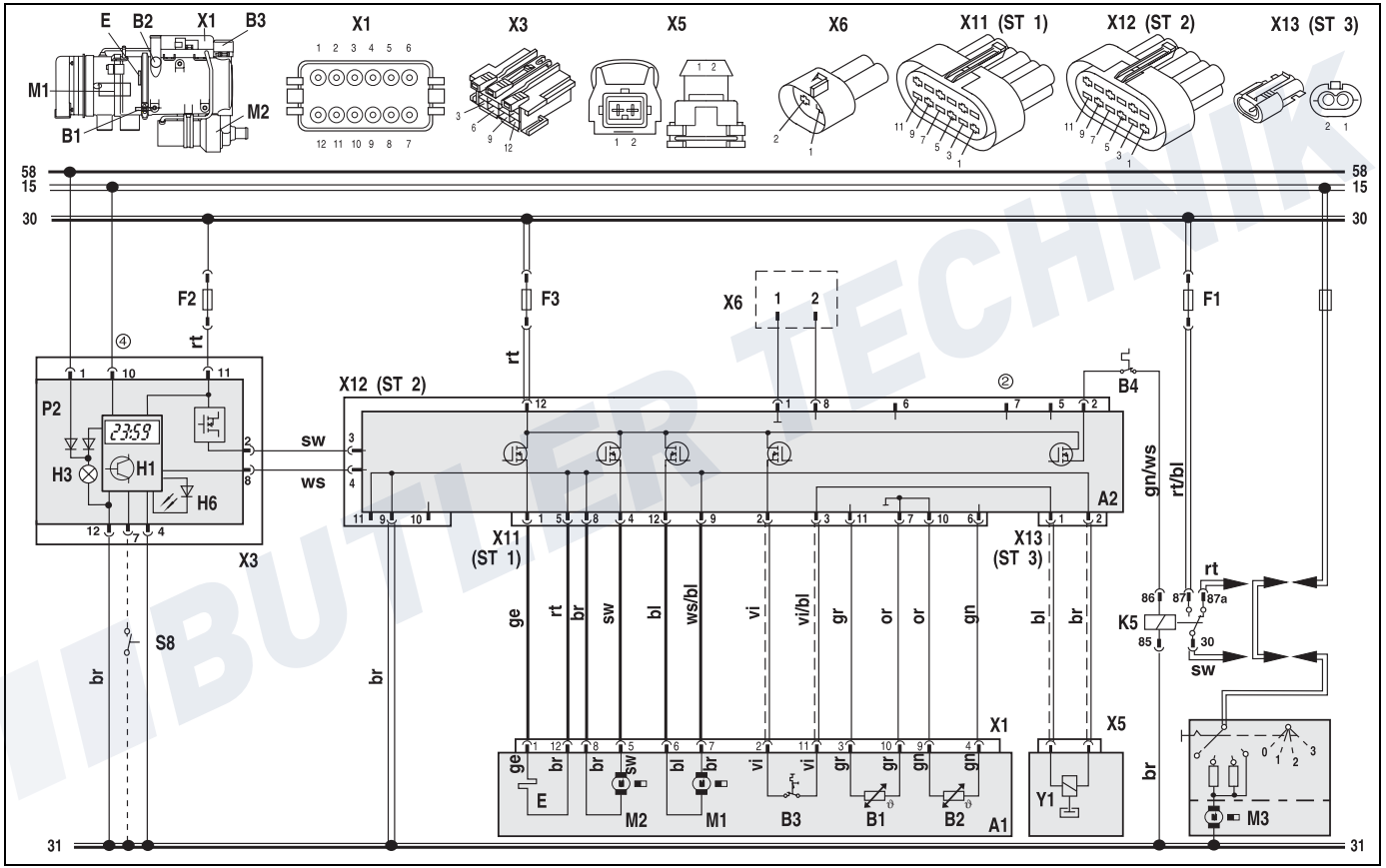


Fig. 15: System circuit for Thermo 90S, 12 and 24 V, with standard timer, see pages 51 and 52 for legend

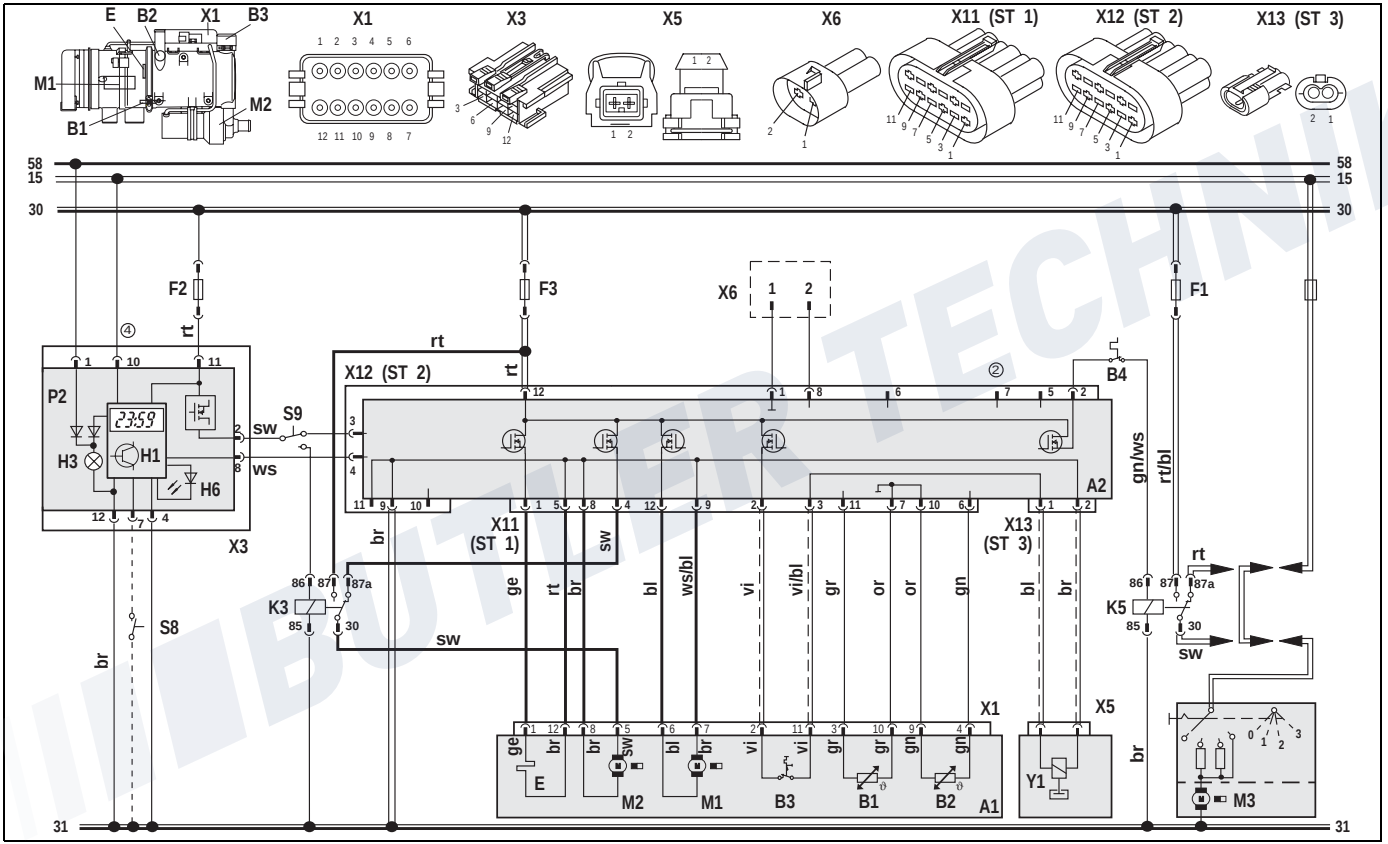


Fig. 16: System circuit for Thermo 90 S, 12 and 24 V, with standard timer and separate circulating pump control, see pages 51 and 52 for legend

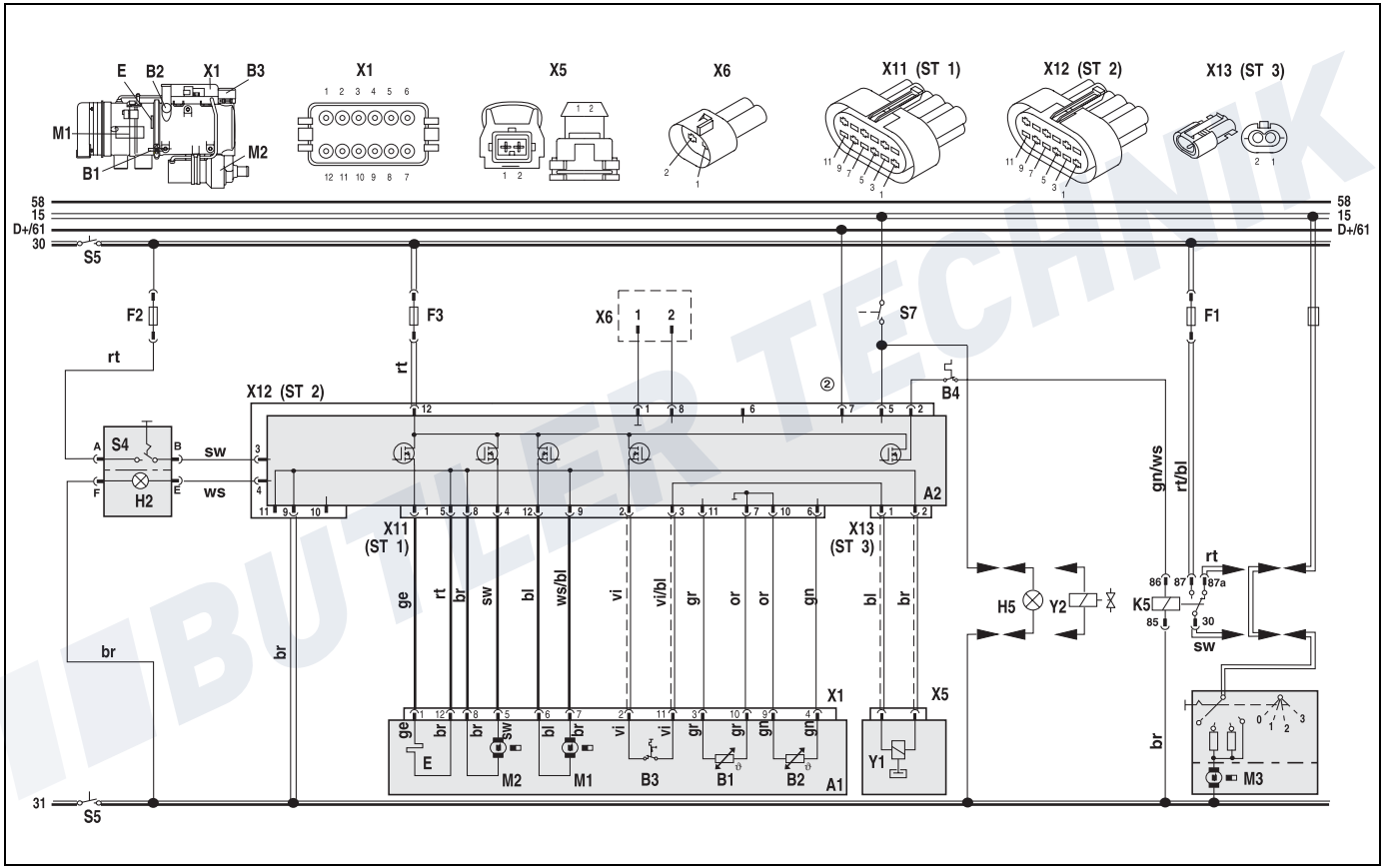


Fig. 17: System circuit for Thermo 90 S – ADR, 24 V, with switch, see pages 51 and 52 for legend

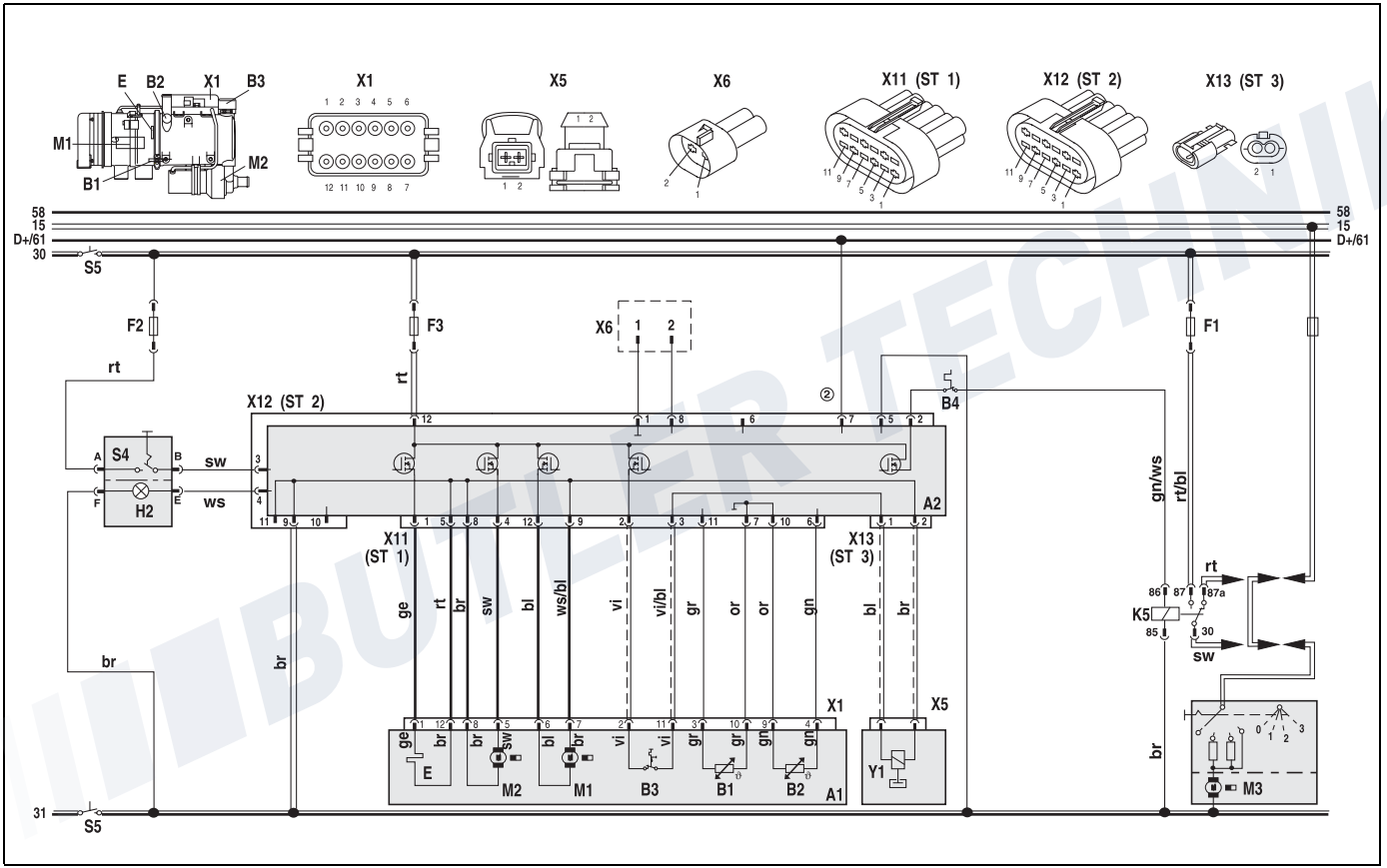


Fig. 18: System circuit for Thermo 90 S – ADR, 24 V, with switch without auxiliary drive, see pages 51 and 52 for legend

10.3. Thermo 90 ST circuit diagram legend

Item	Designation	Comment
A1	Heater	
A2	Control module	
B1	Flame sensor	
B2	Temperature sensor	
B3	Temperature limiter/ Overheating guard	
B4	Room thermostat	
E	Glow plug	
F1	Fuse 20 A	Flat fuse SAE J 1284
F2	Fuse 5 A	Flat fuse SAE J 1284
F3	Fuse 20 A	Flat fuse SAE J 1284
H1	“Heating” symbol in the display	Operating indicator (in item P2)
H2	Light max. 2 W	Operating indicator (in item S4)
H3	Symbol light	Light (in item P2)
H5	Lamp, min. 1.2 W	Switch-on indicator pumping device
H6	Red LED	Immediate heat button light, ready indicator, switch-on control (in item P2)
K3	Relay	Circulating pump remote control
K5	Relay	for vehicle fan
M1	Motor	Combustion air fan
M2	Motor	Circulating pump
M3	Motor	Vehicle fan
P2	Digital timer	For programmed operation
S4	Switch	ON/OFF
S5	1 or 2-pin disconnecting switch	Emergency off switch, electric or pneumatic
S7	Pumping device switch	to positive
S8	Momentary-contact switch	Immediate heat button remote control
S9	Switch	Heating/Circulating pump remote control
S10	Switch	Battery switch in positive
X1	Plug connector, 4-pin	to item A2
X2	Plug connector, 2-pin	to item A2
X3	Plug connector, 2-pin	to item A2
X4	Plug connector, 2-pin	to item A2
X5	Plug connector, 2-pin	to item A2
X6	Plug connector, 2-pin	to item A2
X7	Plug connector, 2-pin	to item A2
X8	12-pin plug connection	To item A2 (ST 2)
X9	12-pin plug connection	to item P2
X10	Plug connector, 2-pin	W-Bus diagnostic
X11	Plug connector, 2-pin	to Y1
Y1	Metering pump	Fuel pump for heater
Y2	Solenoid valve	for pumping device

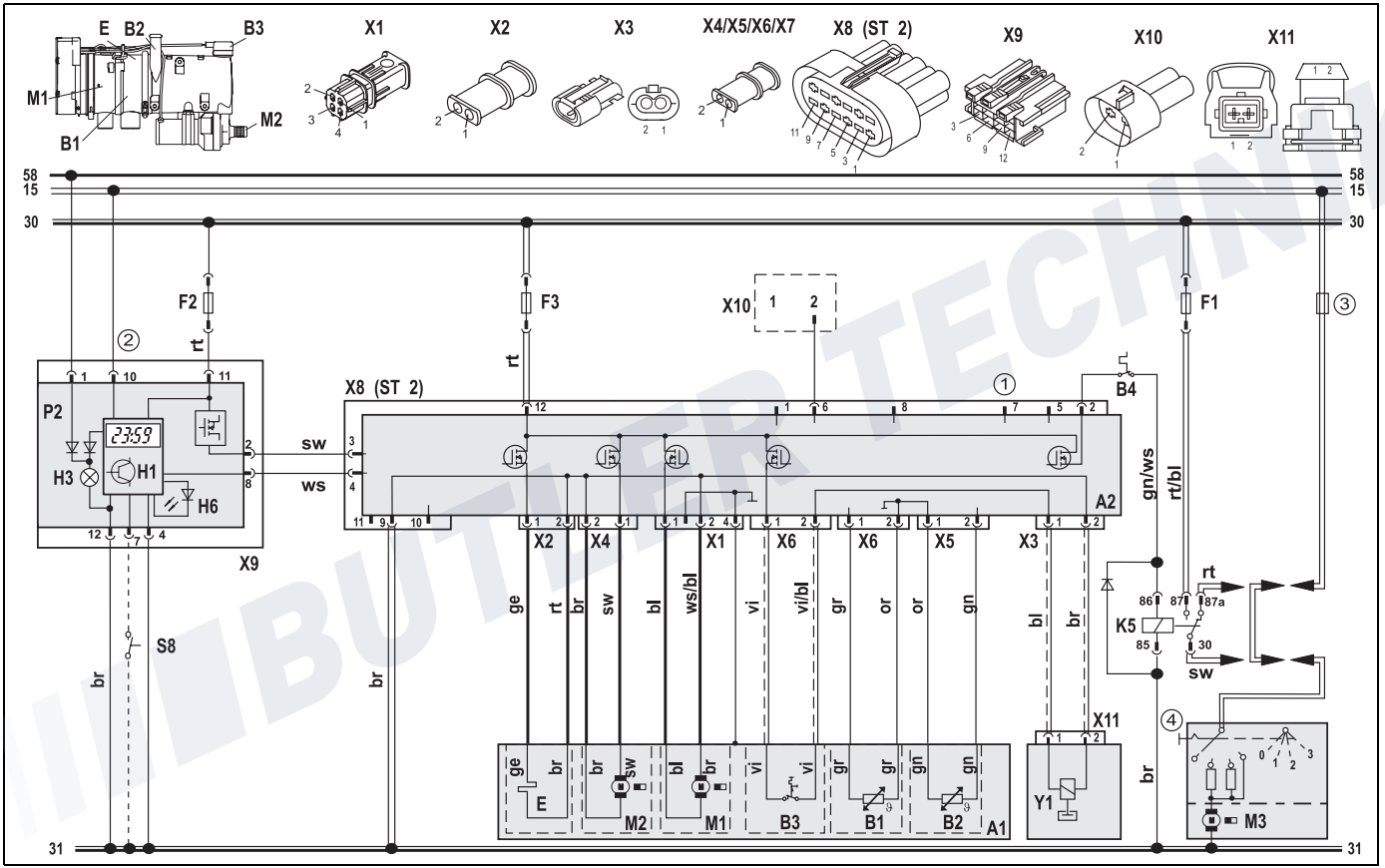


Fig. 19: System circuit for Thermo 90 ST, 24 V, with standard timer, see pages 51 and 57 for legend

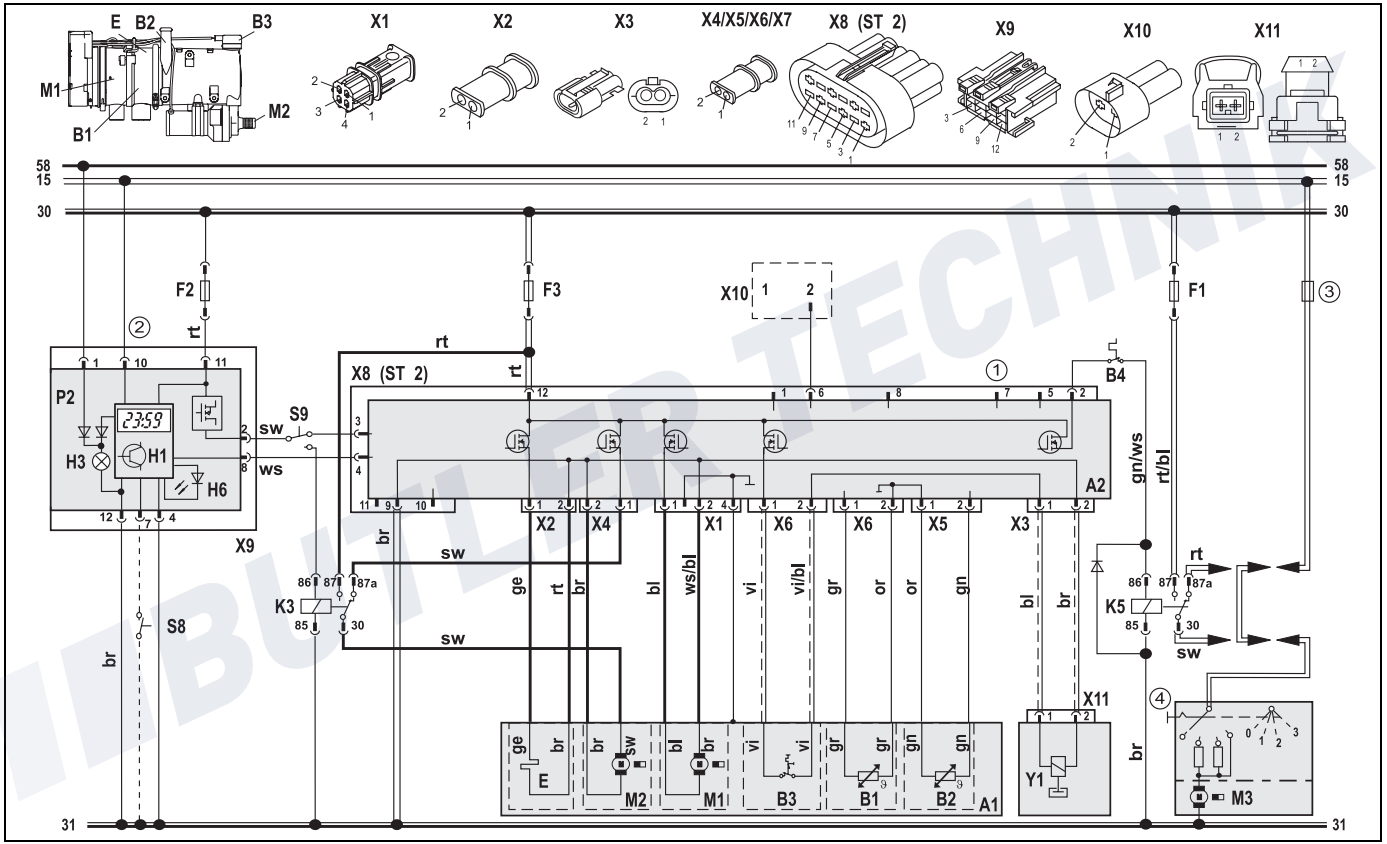


Fig. 20: System circuit for Thermo 90 ST, 24 V, with standard timer and separate circulating pump control, see pages 51 and 57 for legend

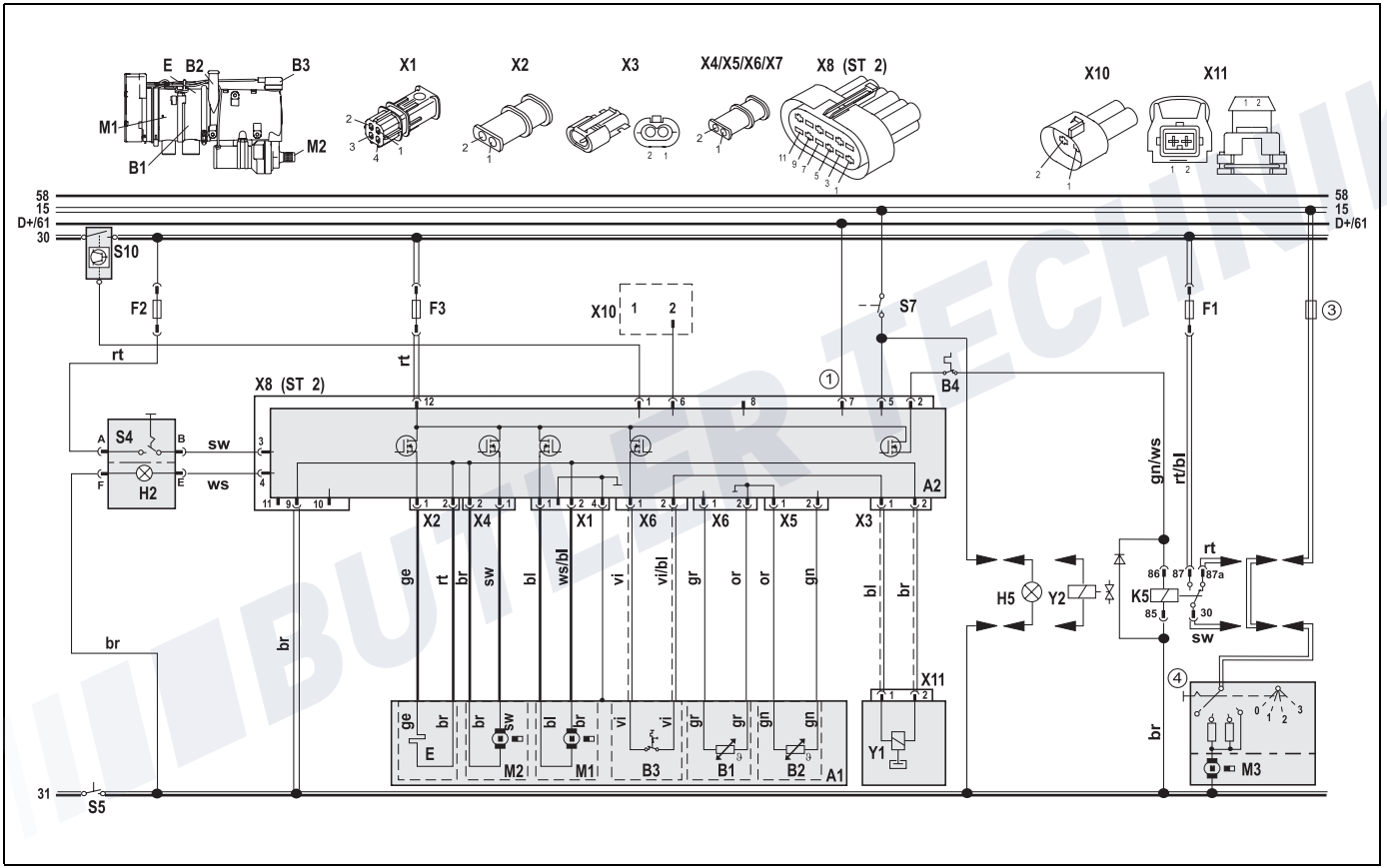


Fig. 21: System circuit for Thermo 90 ST – ADR, 24 V, with switch, see pages 51 and 57 for legend

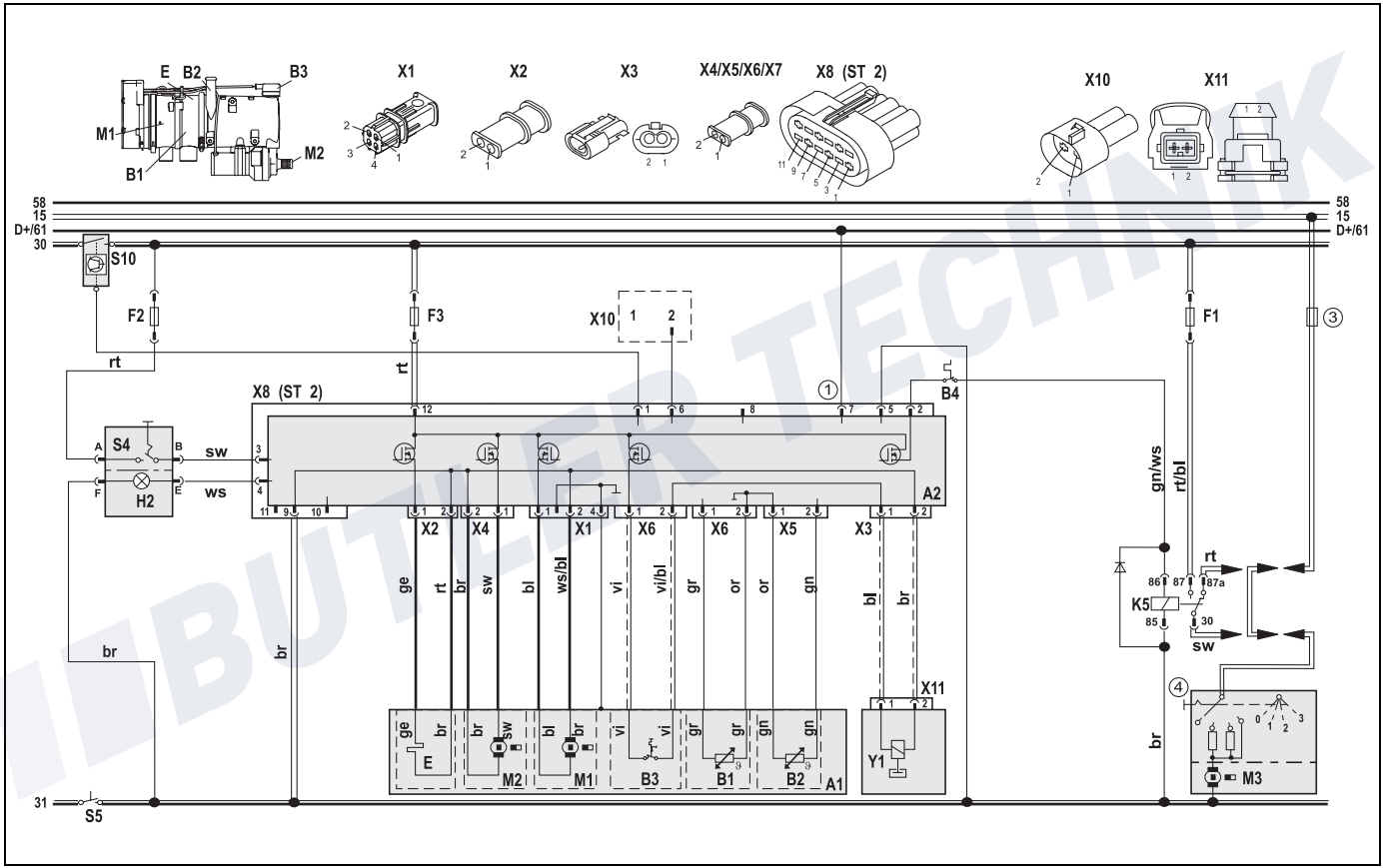


Fig. 22: System circuit for Thermo 90 ST – ADR, 24 V, with switch without auxiliary drive, see pages 51 and 57 for legend

11 Initial start-up

NOTE:
Refer to the safety instructions in the operating and maintenance instructions.
The operating and maintenance instructions must be read through without fail before starting the heater.

After you have installed the heater, bleed the water system and the fuel supply system carefully. Follow the instructions supplied by the vehicle manufacturer for this purpose.

Conduct a trial of the heater to check all the water and fuel connections for leaks and to ensure that they are secure. If the heater suffers a fault during operation, the fault must be located and remedied.

12 Troubleshooting

12.1. Fault lock-out

Fuel is supplied for max. 240 seconds if the flame does not start to burn.

Fuel is supplied for max. 240 seconds if the flame goes out during operation.

The fuel supply is shut off if the system overheats (temperature limiter is tripped).

Once the cause of the fault has been eliminated, the fault lock-out is cancelled by switching the heater off and on again.

If the undervoltage guard switches off the system

	Thermo 90 S	Thermo 90 ST
12 V	10.5V – 0.5V	10.5V – 0.5V
24 V	21V – 1V	21V – 1V

for longer than 20 seconds, the fuel supply is interrupted.

12.2. Diagnostic after a fault lock-out for the Thermo 90 S and Thermo 90 ST

Check the fuses and plug connectors.

12.2.1. Version with timer

If the system is equipped with a standard clock, a fault message appears on the display of the timer after a fault occurs:

F	00	Heater lock-out or control unit defective, Unlocking only possible by an authorised workshop
F	01	No start (after 2 attempts to start)
F	02	Flame failure
F	03	Undervoltage or overvoltage
F	04	Premature flame recognition
F	05	Flame sensor interrupt or flame sensor short-circuit
F	06	Temperature sensor interrupt or temperature sensor short-circuit
F	07	Metering pump interrupt or metering pump short-circuit
F	08	Blower motor interrupt or blower motor short-circuit or blower motor incorrect speed
F	09	Glow plug interrupt or glow plug short-circuit
F	10	Overheating
F	11	Circulating pump interrupt or circulating pump short-circuit

12.2.2. Version with switch

If the system is operated with a switch, the nature of the fault is indicated by a flashing code on an indicator light during the run-on time of the heater.

After five short signals, count the long flashes:

0x	(only five short signals) Heater lock-out or control unit defective, Unlocking only possible by an authorised workshop
1x	No start (after 2 attempts to start)
2x	Flame failure
3x	Undervoltage or overvoltage
4x	Premature flame recognition
5x	Flame sensor interrupt or flame sensor short-circuit
6x	Temperature sensor interrupt or temperature sensor short-circuit
7x	Metering pump interrupt or metering pump short-circuit
8x	Blower motor interrupt or blower motor short-circuit or blower motor incorrect speed
9x	Glow plug interrupt or glow plug short-circuit
10x	Overheating
11x	Circulating pump interrupt or circulating pump short-circuit

13 Technical data

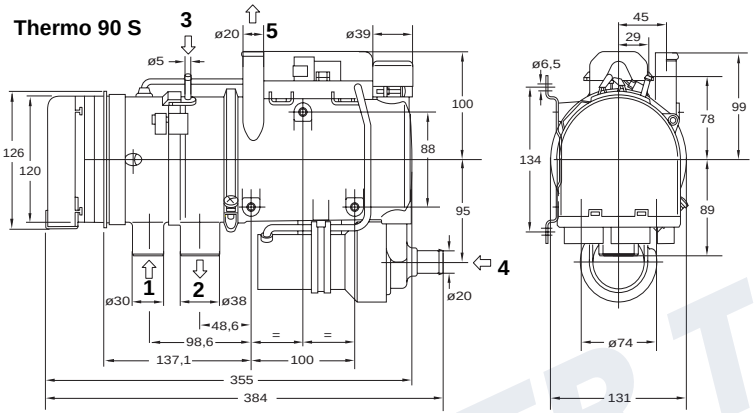
Except where limit values are specified, the technical data on the right refer to the usual heater tolerances of ± 10 % at an ambient temperature of + 20 °C and at nominal voltage.

13.1. Electrical components:
The control module, motors for combustion air blower and circulating pump, glow plug, switch and timer (no timer for ADR mode) are designed for either 12 V or 24 V. The temperature limiter, temperature sensor and flame sensor are identical on 12 V and 24 V heaters.

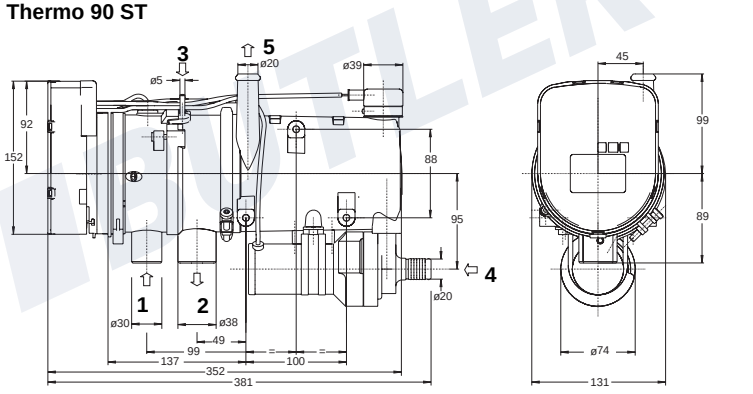
13.2. Fuel for Thermo 90 S and Thermo 90 ST petrol:
The fuel specified by the manufacturer must be used.
Both leaded and unleaded fuel may be used.

13.3. Fuel for Thermo 90 S / Thermo 90 ST and Thermo 90S-ADR /Thermo 90 ST-ADR (diesel):
The diesel fuel specified by the manufacturer must be used.
We know of no negative influences due to additives. If fuel is extracted from the vehicle's tank, follow the additive instructions issued by the vehicle manufacturer.
If you change to low-temperature fuel, the heater must be operated for approx. 15 minutes so that the fuel line and fuel pump are filled with the new fuel.

Heater	Operation	Thermo 90 S / ST Petrol	Thermo 90 S diesel Thermo 90 S-ADR	Thermo 90 ST diesel Thermo 90 ST-ADR
EC licensing symbol		00 0005* / 00 19*	00 0005*	
Model		Water heater with Ferro-tec technology		
Heat output	Max. regulating range	2.0 kW – 7.6 kW	9.1 kW 1.8 kW – 7.6 kW	
Fuel		Petrol	Diesel	
Fuel consumption	Max. regulating range	0.25 l/h – 1.0 l/h	1.1 l/h 0.19 l/h – 0.9 l/h	
Rated voltage		12 V	12 or 24 V	
Operating voltage range		10 ... 15 V	10 ... 15 or 20 ... 30 V	
Nominal power consumption with circulation pump (without vehicle fan)	Max. regulating range	37 W - 83 W	90 W 37 W - 83 W	
Max. ambient temperature: Heater: - Operation		-40° ... +110 °C (90 °C with control module installed on the heater)		
- Storage		-40° ... +110 °C (90 °C with control module installed on the heater)		
Control module: - Operation		-40° ... +75 °C	-40° ... +75 °C	-40° ... +85 °C
- Storage		-40° ... +85 °C		
Metering pump: - Operation		-40° ... +20 °C	-40° ... +40 °C	
- Storage		-40° ... +85 °C		
Max. operating pressure (heat medium)	Max.	2.0 bar		
Capacity of the heat exchanger		0.15 l		
Max. combustion air intake temperature		+40 °C		
Minimum capacity of the system		6.00 l		
Delivery rate of the circulating pump against 0.15 bar		1650 l/h		
CO_2 in the exhaust fumes (normal function range)	Max.	10 ... 12.0 % by volume		
CO_2 - adjustment values at approx. + 20 °C and geographic altitude above sea level	Max.	0 m 500 m 1000 m 10 % 10.6 % 11.3 %		
Heater dimensions (tolerance ± 3 mm) * Control module installed on the heater		L 310 (355*) / 307(352*) mm W 131 mm H 232 mm	L 310 (355*) mm W 131 mm H 232 mm	L 307 (352*) mm W 131 mm H 232 mm
Weight		4.8 kg		



1 Combustion air intake
2 Exhaust fume outlet
3 Fuel intake
4 Coolant intake
5 Coolant outlet



1 Combustion air intake
2 Exhaust fume outlet
3 Fuel intake
4 Coolant intake
5 Coolant outlet

Fig. 23: Dimensions of the Thermo 90 S / Thermo 90 ST heaters

Im Fall einer mehrsprachigen Version ist Deutsch verbindlich.

In multilingual versions the German language is binding.

Dans le cas d'une version rédigée en plusieurs langues, l'allemand est alors la langue qui fait foi.

Webasto AG
Kraillinger Strasse 5
82131 Stockdorf
GERMANY

http://dealers.webasto.com
http://www.webasto.com

Änderungen vorbehalten
Subject to modification
Sous réserve de modifications

IDENT.-NR. 1301494C